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A Description

Method and Device to form Stacks

The invention concerns a method and a device to form stacks of objects.

In production facilities, stacks are frequently created that need to be subsequently packaged. The packaging frequently occurs in the form of stacks in which the objects are arranged side-by-side. However, they are manufactured and delivered sequentially in the production facility. In order to package them as a stack, the sequentially delivered objects need to be arranged so that they form a stack.

To form a stack, it is known to supply the normally flat objects to a transfer wheel where they are conveyed along a circular arc up to a stop extending radially in relation to the transfer wheel. They are then shoved radially outward. The objects to be stacked then lie on each other so that they form a stack.

A second possibility is to shove the objects into compartments of a compartment device that has a plurality of compartments that for example are moved along a closed path. By generating an apparent stoppage, several objects can then be simultaneously ejected and form a stack after leaving the compartments.

A device to form stacks is already known (US 5,897,292) where a plurality of compartments is moved along a closed path. The compartments are separated from each other by compartment walls. In each second compartment, the compartment walls are connected to each other on the inside so that an object shoved into them remains in the compartments. In the intermediate compartments, the compartment walls are not joined so that an object shoved into them can be shoved through the compartment walls. A transport device is then used to shove the object in reverse orientation into a compartment at that location on the opposite side. Neighboring objects then lie against each other in reverse orientation.

The invention is based on the task of providing a method and/or a device for forming stacks that improves stacking under specific conditions.

To solve this task, the invention proposes a device with the features of claim 1 and/or a method with the features of claim 11. Developments of the invention are the subject matter of the respective dependent claims.

The device is used to first insert the objects into the compartments, and one object lies in each compartment. In certain circumstances, it is also conceivable for two parallel objects to be arranged in each compartment. Then as processing proceeds, an individual object is removed, for example ejected. This object is then shoved into another compartment. Individual objects can be reoriented in this manner. A special application addressed by the invention is when the objects have a certain asymmetry, for example they are thinner toward the front than towards the back. To form stacks, especially when the objects do not have a stable shape, it is recommendable to orient two neighboring objects opposite each other so that the face that is less thick neighbors a face of the neighboring object that is thicker.

The invention can also be used in procedures where such an alternating orientation is desired for other specific reasons.

The steps of the method proposed by the invention are as follows: The objects are first arranged next to each other in compartments, and preferably no compartment remains free. While inserting the objects sequentially, the series of compartments is preferably continuously moved perpendicular to the compartment arrangement. Then the individual object is removed from the series of adjacent objects and inserted into an empty compartment. At a withdrawal site, a serious of adjacent objects is then removed from the compartments and ejected as a stack.

In a development of the invention, the transfer device can be designed so that it

inserts the object into the same compartments of the compartment series from which it removed the object. This can for example be achieved by storing the removed object for a certain period in the transfer device until the object can be reinserted into the same compartment.

Within the scope of the invention, it is also possible to insert the object into a different compartment of the compartment series.

In another development of the invention, the transfer device can be designed so that it removes the object from the compartment, possibly storing it for a while, and then reinserts it into the one or other compartment without changing the orientation of the object. The possible reorientation in relation to the neighboring objects arises from the remaining objects in the compartments executing a different movement.

According to the invention, the compartment device can be designed so that it moves the compartments along a path having two at least approximately parallel sections, and these two sections move in opposite directions.

In particular, the path along which the compartments are moved can be a closed path that for example has two parallel or approximately parallel sides. The compartments can be located on a revolving chain, belt, etc., or on any other transmission means that moves along a closed path.

In this case, it is particularly easy to eject an individual object out of a compartment, to store it for a while between the two parallel sides, and to then insert it into the now empty compartment passing by at the same site as the compartment device continues to move.

To first insert the objects into the compartments, a supply device according to the invention can be provided that guides the objects sequentially and shoves them into the empty compartments.

To then eject the formed stack with alternately oriented objects out of the compartment device, the device can have a device to generate an apparent stoppage at this site of the ejection device. This apparent stoppage can be achieved by moving the two deflection wheels (around which the chain runs) together in a linear fashion at a specific speed, but of course only for a certain period.

The transfer device can advantageously have a servodrive for two directions of movement to initially elevate the object to be removed, and then horizontally eject it perpendicular to the direction of movement of the series of compartments.

In particular in a development, the transfer device is designed to transfer a plurality of individual objects out of and into non-neighboring compartments.

Additional features, details and preferences of the invention are found in the following description of a preferred embodiment, the patent claims and the abstract whose wording is hereby made a part the description by means of reference, and in the drawing.

Fig. 1 shows a schematic overhead view of a device according to the invention;

Fig. 2 shows an enlargement of the state shortly before two objects are ejected;

Fig. 3 shows a situation similar to Fig. 2 during ejection,

Fig. 4 shows a situation similar to Fig. 2 and 3 shortly before the ejected object is inserted into the series of compartments at another place along its path of movement;

Fig. 5 shows a simplified representation of a part of the transfer device.

Fig. 1 portrays a compartment device 1 having a chain 2 that is guided around two rotating, mounted deflection wheels 3. The deflection wheels 3 have a vertical rotary axis 4. The chain 2 is tightened so that it is taut. On the outside of the chain 2, there are compartments 5 that are delimited by two sidewalls 6. The compartment walls 6 are either affixed to the chain 2, or are at least mounted so that they are entrained by the chain 2. The device that moves the compartments 5 is perpendicular to the compartment arrangement. Only some compartments 5 are shown in Fig. 1 for reasons of simplification.

The vertical bearing axes 4 of the two deflection wheels 3 are on a common rail so that the entire arrangement can be moved to the right and left, i.e. in a direction parallel to the connecting axis of the two bearing axes 4. When this movement is executed, the two sides of the chain 2 remain in the same plane.

To drive the two sides 2a, 2b of the chain 2, two drive gears 7 are provided that are driven independent of each other via a drive and are also controlled independently of each other. When both drive gears 7 are driven at the same speed, the position of the two deflection wheels 3 remains constant. When one of the drive gears 7 is driven faster, the entire arrangement consisting of the chain and deflection wheels 3 shifts. It is thereby possible to bring about an apparent stoppage of one side of the chain 2 at a specific location.

On one side of the device shown at the top in Fig. 1, there is a supply device 8 that sequentially accepts objects 9 coming from a production system and shoves them into compartments 5. The objects 9 first lie flat and are set upright by the supply device 8. To accomplish this, the supply device 8 has two conveyor belts 10 between which the objects 9 are arranged. Each conveyor belt 10 is guided around two rollers 11. At the entry into the supply device 8, the two rollers 11 are horizontal, and at the output end of the supply device 8, they are vertical. The objects 9 are thereby rotated when they are transported.

The objects 9 are then arranged in the compartments 5 and are moved in the direction of the arrow 13.

An ejection device 14 is approximately at the same location on the opposite side of the device, and it uses a slide 15 to shove out a series of neighboring objects out of the compartments 16 perpendicular to the direction of transport. This ejection is indicated by the wide arrow 17.

Between the two sides 2a, 2b of the chain 2, there is a transfer device 20 that is shown in Fig. 1 in a very simplified form. The transfer device 20 is designed so that an individual object 9 in a compartment 5 is removed from the compartment 5 on side 2a and moved to the opposite side where this object 9 is inserted into an empty compartment on side 2b without changing its orientation. Stated simply, an individual object can be ejected from above to below in Fig. 1, and the ejection movement and chain 2 transportation are harmonized so that the object 9 enters an empty compartment on side 2b. Since all the objects in the compartments of side 2b that execute this movement change their orientation by traveling around the deflection wheel 3, the orientation of the object ejected by the transfer device 20 is opposite that of the other neighboring objects in the two adjacent compartments.

This procedure is schematically portrayed in Fig. 2-4. Fig. 2 and 3 show an enlarged section of side 2a, whereas Fig. 4 shows a section from side 2b on the same scale.

Fig. 2 therefore shows a section from the compartment device with five compartments that each contain one object 9. To better portray the orientation, each object 9 is represented as a triangle. The objects 9 are conveyed by the supply device 8 in the same alignment as they leave the production facility. On side 2a, all objects 9 have the identical orientation. The transfer device 20 contains a

plurality of individually or jointly actuatable slides 21 that contact two objects 9. These two objects 9a are in two compartments 5 that are separated from each other by an additional compartment 5. The distance between the two slides 21 in the direction in which the compartment device is transported (see arrow 13) is twice as large as the distance between two neighboring compartments 5. The two slides 21 contact the objects 9a, and move them outside of the compartments perpendicular to the direction of movement 13 of the compartment device. The objects 9a assume the intermediate position shown in Fig. 3, and pass from there between the guide walls 22 indicated in Fig. 1. Without changing their orientation, the objects 9a are then advanced further either by slides 21 or another slide until they are shoved into the available empty compartments on side 2b. The empty compartments 5 on side 2b can be the same compartments from which the objects 9a were ejected. This can be accomplished by slowing the movement within the guide walls 22, or waiting until the corresponding compartment is on the opposite side.

As can be seen in Fig. 8, the orientation of the objects 9, 9a at this location is alternatingly opposite so that, when the objects are ejected by the ejecting station 14, a compact and well-aligned stack arises. The stack has been adjusted to compensate for the asymmetrical shape of the individual objects. The asymmetry in the drawings has been strongly exaggerated.

The transfer device has brought about the reorientation of each second object without requiring a complicated path of movement. This reorientation without complicated movement is particularly helpful for objects that would create a stack that is difficult to handle because of their asymmetry. This method can also be used in all other cases in which the resulting stack requires an alternating orientation, even when the objects are not asymmetrical.

Fig. 5 shows a simplified design of a slide 21 of the transfer device. The slide 21 has a horizontal plate 23 and a vertical contact plate 24. It is connected via a

transfer element 25 to a servodrive 26 that can move the transfer element 25 up and down in the direction of the double arrow 27, and that can also execute a horizontal movement in the direction of the double arrow 28 with the aid of the transfer element 25. Since the objects in the compartments 5 lie on the chain 2 or an element connected to it, the object 9a first needs to be lifted until it can be shoved horizontally over the stop. On the opposite side, a similar device can ensure that the object is lowered into the compartments 5.
